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The Application of Microcomputers in Acquiring Multiplication Facts Mastery

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The Application of Microcomputers in
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Abstract

Recall of multiplication number facts is a major educational objective in elementary grades, yet some children never acquire total mastery. A microcomputer multiplication number facts training program was developed which incorporated programmed instructional features including feedback, positive reinforcement, vanishing, branching and pairing. Additionally, skip counting both forward and backward was emphasized. Thirty third-grade subjects completed the training and the results indicated that the mean performance of the subjects increased from 17% to 94%. This level of performance was maintained when tested 4 months later. Mean performance of the treatment group was significantly greater than the non-treatment group. Implications for further study were discussed.

Despite the fact that accurate and automatic recall of basic multiplication number facts is a major objective of elementary mathematics educators (Schulz, 1972; Paige et al., 1978; Denmark and Kepner, 1980; and Resnick and Ford, 1981), it is evident that a significant number of children have considerable difficulty in mastering this goal. For some children total mastery is never achieved. Bright (1978) reports that the range of mastery varies from 67% to 97% for the 100 multiplication number facts. That is, some individuals are able to recall only two thirds of the multiplication number facts after elementary school years have been completed. This situation persists because, as Campbell and Graham (1985) assert, there is neither cogent theory nor extensive, relevant research to explain how number relationships are acquired and recalled. Acquisition of multiplication number facts may be more difficult than educators realize.

The purpose of this study was an attempt to foster accurate and automatic recall of basic multiplication facts through self-instruction based on a model in the paired-associate learning tradition. Specifically, this study addressed the problem of attempting to develop a systematic multiplication number fact microcomputer training program and ascertaining its effectiveness.

The following questions were asked in the present study. First, prior to the introduction of formal multiplication number fact instruction in the classroom, would subjects acquire accurate recall of multiplication number facts as a result of the

microcomputer training program? Second, was the subjects' level of response accuracy maintained over time? Finally, are there particular multiplication number fact combinations that contribute to inaccurate recall rate and, if so, what are they?

PERSPECTIVES

While it is well known that some children seem to achieve mastery of multiplication facts using their own idiosyncratic strategies, methodological and other limitations hinder understanding of exactly what strategies children use, in general, and how these strategies come about (Resnick & Ford, 1981). Even though current speculation by mathematics educators indicates support for the notion that recall involves reproduction of specific numerical associations, still most elementary school teachers and many widely used elementary mathematics textbooks depend upon the use of a reconstructive (understanding) approach as a basis for instruction. These texts stress concept acquisition. Typically, third grade teacher's manuals do not clearly explain the importance of drill and practice or the relationship between conceptual understanding and drill and practice exercises. The difficulty many children encounter in acquiring proficiency in multiplication may be due, in part, to the ambiguity about how instruction should, and in fact, does proceed (Mich, 1985).

Educators and psychologists have studied the impact of computer aided instruction in terms of skill acquisition. Many studies focusing on mathematics instruction have compared computer assisted instruction with some other method (e.g., paper

and pencil). More recently, Burns and Bozeman (1981) in reviewing the computer assisted literature have concluded, via their "meta-analysis" approach, that a carefully structured computer instructional program, per se, can provide significant opportunity for learning process enhancement compared to traditional instruction which does not include computer support.

With the availability of computer technology, a number of studies have been conducted which combine instruction with research on optimal approaches to teaching. A few researchers have explored the possibility of tailoring drill programs to the ability level of children in order to enhance computational skills. Suppes and Morningstar (1972) developed a drill-based program that utilized the computer to provide practice on computational skills that were taught in the elementary grades in the mathematics subject area. In this study drill and practice was deemed an integral component in acquiring competence in computational tasks. The program was designed to allow children to gain practice in the four arithmetic processes as well as per cent and ratios. Children were provided with continuing feedback concerning the correctness of their responses and appropriate problem challenge level was individually assigned based on performance. Children meeting criterion advanced. Those scoring below remained at the assigned level. Results based on SAT test scores indicated children receiving computer assisted instruction improved significantly more than the control children receiving regular classroom instruction. Inadvertantly, one of the control schools supplemented classroom instruction with paper and pencil sessions. These children receiving additional practice exceeded

the posttest scores of the computer assisted instruction children. The results suggested that practice, itself, as opposed to computer assisted instruction activities accounted for performance improvement.

MacLean (1973) reported that the response accuracy on a multiplication number fact posttest of students using computer-based instruction was significantly greater than students who received non-computer instruction. MacLean attributed the difference in response accuracy to the capability of the computer program to provide immediate error checking, feedback, and remedial sequences over a prolonged period of time. Jacobson (1976) reported a multiplication response accuracy of approximately 90% for third grade students who completed the multiplication portion of a program developed to teach number facts. This finding, which is similar to those findings reported by Suppes and Morningstar (1972) and MacLean (1973), indicates that despite intensive computer based drill and practice response accuracy reaches a level near 90%.

These studies suggest that computer aided multiplication instruction can offer systematic, sustained and individualized practice and performance tracking and can do so more often and efficiently than the classroom teacher. In practice a teacher can usually correct only a random sample of student responses on an occasional basis. Consequently, students in a non-computer instruction setting might complete relatively large amounts of work before errors would be caught and corrected. A computer aided instructional program could also provide a private,

relatively non-judgmental setting in which students could obtain the multiplication drill and practice necessary to acquire the basic skill.

These studies also indicate that some unresolved issues remain. First, the computer programs in these studies were designed and written for mainframe computers; a program written for a microcomputer would make instruction more accessible to more classrooms. Second, it is instructive, although somewhat disconcerting, to discover that major efforts, as reported in the literature, to increase multiplication response accuracy have resulted in percentage scores ranging from 77% to 92%. The instructional approach employed in these studies was similar. In part, this instructional approach may account for a level of response accuracy that indicates only partial mastery of a vital skill. It seems plausible that providing instructional steps that build upon the inherent relationship of the products in a number fact table (e.g., skip counting forward and backward) might offer the possibility of affecting and contributing to a higher response accuracy. Third, greater attention needs to be given to errors and their elimination. A possible method of intercepting errors is to baseline the subject's acquisitional level at the outset of each instructional session. In this manner errors could be identified and appropriate practice could be given. Finally, one of the recurrent questions in research efforts concerns the duration of effects. Such a question also seems imperative in any multiplication number facts acquisition study. That is, if an appropriate response accuracy level is achieved, is this level maintained over time?

METHODS

The multiplication number fact training program consisted of four parts: 1) a pre-assessment recall of multiplication number facts; 2) a skip counting sequence (forward and backward); 3) combining number fact products and factors (forward and backward); and 4) an immediate post-assessment recall of multiplication number facts. Major programmed instruction features were incorporated into the multiplication training program including immediate feedback, audible error cues, written statement reinforcements, response correcting, vanishing, subject response percentages, formal and thematic prompts, branching, and successive approximation. Advancement to successive multiplication tables was contingent upon achieving criterion levels.

Sample. Subjects for this study were third grade students selected from three classrooms from a Catholic school system in a predominantly lower middle class community in a large Midwestern city. None of the classroom teachers had begun formal instruction of the multiplication number facts. Thirty students were randomly chosen as treatment subjects. Twenty-four students comprised the non-treatment group. The non-treatment group was comprised of students in the targeted classrooms who had not participated in microcomputer instructional training.

Table 1 presents the SRA standardized test scores for the treatment and non-treatment groups. A comparison of the means indicates that the two groups were not significantly different in terms of age, SRA ability quotient, and SRA mathematics and

reading subtest scores.

Table 1 approximately here

Procedures and Instruments. The treatment phase consisted of individual training sessions, lasting approximately 15 minutes each. The training sessions were supervised by the investigators. Three paper and pencil assessments of the 100 multiplication number facts were given to both the treatment and non-treatment groups. The first was administered prior to microcomputer instruction, the second was administered after the treatment group had completed the microcomputer instruction, but before classroom instruction of multiplication, and the third was administered after classroom instruction of multiplication had been presented (approximately four months after completion of microcomputer instruction).

Results. The instructional program lasted for a total of 49 school days. There was a total of 744 scheduled 15 minute trials. The mean number of trials per day was 15.2.

Table 2 presents the means and standard deviations of training data, i.e., drill and practice trials, responses, and errors. The results in Table 2 show that the mean number of trials per subject was 24.8, the mean number of responses per trial was 113.9 and the mean number of errors per response was 2.3 per 100 responses.

Table 2 approximately here

Table 3 presents the means and standard deviations on the three paper and pencil assessments for both the treatment and non-treatment groups. A comparison of assessment 1 of the treatment group and assessments 1 and 2 of the non-treatment group shows no significant difference between any of the three means at a level of significance of 0.10. This indicates that both groups were at the same level of competence on the multiplication tables prior to instruction and that the improvement of the treatment group may be attributed solely to the use of the microcomputer instructional program.

Table 3 approximately here

These results also show that the average level of response accuracy for the treatment group following microcomputer instruction was 93.7%. This average increased to 95.5% when assessment 3 was administered four months later, indicating that the level of response accuracy was maintained over time. In fact, the scores appear to have increased slightly although the significance of this increase is difficult to ascertain because of a ceiling effect on the scores (i.e., the maximum score is 100). As nearly as could be determined, a practice effect, (i.e., coupling microcomputer instruction with classroom instruction) was held to a minimum. During interviews with randomly chosen treatment subjects, the children invariably reported that, since they "knew their tables", they were exempted from regular multiplication instruction and were assigned other

educational activities, not necessarily related to mathematics instruction.

A comparison of scores on assessment 2 for the treatment group and scores on assessment 3 for the non-treatment group (93.7% versus 81.8%) shows a significant difference between performance following microcomputer instruction and classroom instruction of the multiplication number facts. This indicates that the microcomputer instructional program is at least as effective as classroom instruction in this area and suggests the possibility that it may be more effective.

The difficulty of the multiplication number facts was examined in terms of (a) the incorrect responses on the Exit and Follow-up assessments and (b) drill and practice trials per number fact table. Table 4 presents the number and percentage of incorrect responses on assessments 2 and 3 for the treatment group. (These two assessments as administered to the treatment group will hereafter be referred to as the Exit and Follow-up assessments). The results are given for each multiplication number fact table; a relationship is depicted graphically in Figure 1. It should be noted that, due to the high level of response accuracy on the Exit (93.7%) and Follow-up (95.5%) assessments, a relatively small number of incorrect responses was identified on each assessment (Exit n = 189; Follow-up n = 135) The results in Table 4 indicate that the 6's, 7's, and 8's tables account for 118 of 189 (62.4%) and 83 of 135 (61.5%) incorrect responses identified, respectively, on the Exit and Follow-up assessments. Thus, data obtained from this sample of

students indicate that incorrect responses most often occur in the 6's, 7's, and 8's number fact tables.

Table 4 and Figure 1 approximately here

An analysis of the incorrect responses on the Exit and Follow-up assessments was undertaken in order to discern the most frequently missed multiplication number facts, i.e., "difficult" number facts. Tables 5 and 6 present, respectively, the frequency of error for each number fact tested on the Exit and Follow-up assessments. The data in these tables indicate that 189 Exit assessment errors occurred on 59 number facts and 135 Follow-up assessment errors occurred on 41 number facts.

Tables 5 and 6 approximately here

Table 7 presents the frequency of difficult number facts as identified on both the Exit and Follow-up assessments. The 20 number facts with seven or more incorrect responses included:

8 x 8	7 x 8	7 x 6	7 x 7	6 x 8	4 x 8	7 x 9
8 x 6	6 x 7	7 x 4	9 x 8	8 x 4	8 x 7	8 x 9
1 x 1	4 x 7	6 x 6	9 x 6	9 x 7	3 x 8	

The results indicate that, with the exception of 1 x 1, the 20 most difficult number facts include at least one factor greater than five.

Table 7 approximately here

The difficulty of the multiplication number fact tables was also described in terms of the amount of drill and practice trials spent per table. The mean, standard deviation, and range of drill and practice trials per table are presented in Table 8. The upper and lower limits of 95% confidence intervals for each mean are also given in Table 8. The mean number of trials per table is presented graphically in Figure 2.

The results indicate that, in general, the mean number of trials per table increases progressively from 1.4 trials in the 2's table to 4.2 trials in the 6's tables; the exception to the increasing trend is the 5's table where the mean drops to 0.9 trials. From the 6's (4.2 trials) through the 9's tables (0.6 trials) the mean number of trials decreases. Thus, the data indicate that the tables presented first required more drill and practice than those tables presented later.

The distinct dip in the upward trend of the curve in Figure 2 at the fives table is not surprising. It has been suggested that the heavy use of the multiples of five (e.g., telling time, nickles in currency, and skip counting by fives) has a strong effect on acquiring number facts. This low point on the curve seems to reflect the effect the extraordinary use of the multiples of five has had on the acquisition of the number facts in the fives table.

Table 8 and Figure 2 approximately here

In terms of the mean number of trials per table, the 3's

(3.6), 4's (3.8), and 6's (4.2) were the "most difficult" tables and the 2's (1.4), 5's (0.9), and 9's (0.6) were the "least difficult" tables. Since the confidence intervals of the most difficult and least difficult tables are disjoint it appears that there is a significant difference in the mean number of trials required for the two subsets of tables.

DISCUSSION

This study extends the literature by focusing directly upon the acquisition of multiplication number facts utilizing the microcomputer instead of the usual design of comparing two different approaches (c.f. Fuson et al. 1985). The primary purposes of this study were to develop a microcomputer program which would promote the acquisition of multiplication number facts and then to determine its utility.

The subjects' performance on the microcomputer instructional program revealed that the program can be completed in a relatively short period of time, and the program provides for nearly error free practice. The analyses reported indicated that subjects required approximately 25 trials to complete the instructional program. The mean number of trials children required to complete the program is not unlike the number of lessons recommended in popular elementary school mathematics textbooks. The authors of the Harcourt Brace Jovanovich (May, et al., 1981) and Macmillan (Thoburn, et al., 1982) textbooks include 18 and 20 multiplication lessons in the instructional units in their respective textbooks. It should also be noted that the subjects' responses during drill and practice were

highly accurate; on the average, errors occurred at the rate of approximately 2 errors per 100 responses.

Upon completion of the training program the average performance of treatment subjects increased from 17% to 94% based on the multiplication number facts assessment comprised of 100 problems. During the same period performance of the non-treatment group did not change significantly. This is a clear indication that the treatment subjects achieved near mastery in recalling multiplication number facts. And this mastery seems to be directly attributable to the use of the microcomputer training program. Although this study did not intend to compare microcomputer instruction with regular classroom instruction, the results of an assessment immediately upon completion of the training program by treatment subjects (94%) in relation to the obtained response accuracy of the non-treatment subjects after formal classroom instruction (82%) suggests the relative advantage of microcomputer instruction. A study designed to clearly compare the two approaches is warranted.

The second major question concerned the level of response accuracy upon completing the instructional program compared to the response accuracy four months later. At the outset of the study the treatment and non-treatment subjects had achieved, on the average, less than 20% mastery of the multiplication number facts. Upon completing the instructional program the treatment subjects had achieved a mastery level of 93.7%. This level of response accuracy is slightly greater than the results reported in the literature (c.f. Suppes and Morningstar, 1972; MacLean, 1973; and Jacobson, 1976). The Follow-up assessment revealed

that the level of response accuracy achieved upon completion of the instructional program was maintained four months later. In fact, the level of response accuracy increased slightly over time. Additionally, the Follow-up assessment indicated that treatment subjects not only exhibited superior mastery of the multiplication facts, but also, achieved a mastery level of 95.5%.

The third question concerned the kinds of errors the subjects committed upon completion of the instructional program. Errors on the Exit and Follow-up assessments occurred most frequently under two conditions. First, errors frequently occurred on multiplication number facts when one factor was six or greater. Suppes et al. (1968) reported a similar finding. Second, errors occurred when subjects responded to number fact questions in the sixes, sevens, and eights multiplication number fact tables. Jacobson found this to be true also (1976). Because of the small number of subjects and due to the paucity of errors there was no detectable pattern of errors in drill and practice.

The data shown in Figure 2 is fertile ground for post hoc speculations about multiplication number fact acquisition and performance. Disregarding the distinct dip in the curve at the 5's table, there appears to be a relationship between instructional sequence and the mean number of drill and practice trials per table. Apparently, the tables presented first in the instructional sequence (2's, 3's, 4's, and 6's) require more practice than the tables presented last (7's, 8's, and 9's).

Perhaps children require less practice in the later tables because of an accumulated practice effect. Whatever it is that the children acquire as a result of practicing in the first tables apparently aids them in completing the later tables with less effort. Curiously, the effect of accumulated practice does not appear to carry over to performance on the post-instructional paper and pencil multiplication number fact assessments. More than 60% of the errors on both the Exit and Follow-up assessments occurred in the 6's, 7's and 8's tables. Thus, it could be argued that the frequency of errors in the later tables indicates the subjects' received insufficient practice in these tables. An examination of the effects of scrambling the presentation sequence in the instructional program on the mean number of trials spent in each table and the resultant errors would shed light on these areas.

Since the publication of Thorndike's The Psychology of Arithmetic, the debate about how children acquire knowledge of arithmetic has been a continuous one (Thorndike, 1922; Bushwell & Judd, 1925, Brownell & Chazal, 1935,; Brownell, 1941; Ilg & Ames, 1951; Resnick & Ford, 1981; Baroody, 1985; Ashcraft, 1985). Issues central to the debate revolve around the relative merits of the application of drill and meaning theory. Research evidence can be and has been marshalled to support each side, and as insight grows about how the human memory functions, the sharp dichotomous appearance of drill and meaning begins to blur. For example, in regard to how children acquire number combinations, Baroody (1985) describes current theory as attributing efficient number production to a reproductive process. Adherents of this

viewpoint believe that when a particular number combination cannot be recalled, then reconstructive processes may come into play as a back-up to aid in deriving the number combination.

The practical implication of the drill versus meaning theory debate for educators is not readily discernible. Regardless of the theoretical viewpoint of researchers, elementary school mathematics has as its primary goal computational proficiency. Children's mathematics experience is dominated by computational activity. In terms of multiplication, educators and parents everywhere expect their children to perform multiplication computation quickly and accurately. The focus of the present study was on number fact associations that elementary school children are "expected" to memorize. The primary goal was to develop automaticity of number facts. Although there is little evidence that automaticity directly effects calculation proficiency, it seems plausible that accurate recall of multiplication number facts is analogous to having command of a workable number of sight words in reading. For example, Fry reported that his list of "300 Instant Words" constituted an average of 63 percent of the words in samples from three widely-used series of primary basal readers (1960). Automaticity of word recognition skill seems to be associated with higher levels of reading comprehension (Resnick & Ford, 1981). Thus it could be argued that automaticity of number facts is associated with higher levels of mathematics competence.

Children who have not acquired these "sight words" struggle in word recognition and word analysis tasks. Similar to reading,

children who do not master the multiplication tables may well be hindered in a number of ways. Computational inaccuracies are graded harshly in elementary school. Partial credit is seldom given for "understanding" how the problems could be solved. Inaccurate multiplication number fact recall alone is frustrating to the child, but when the solution to a multi-step problem is affected by number fact inaccuracy, the frustration is compounded. Additionally, the child can not be certain what exactly accounted for the unacceptable solution -- number fact recall inaccuracy or misunderstanding of the procedures. Number fact recall inaccuracies which persist contribute to the child's self-evaluation in terms of how good he is in mathematics. Teachers, too, can be affected by how successful they deem themselves in achieving instructional goals. If goal accomplishment is judged solely on the basis of what is presented in commonly used basal mathematic teacher manuals then their achievement is far from certain. Linkage between the child's conceptual understanding of multiplication number facts and drill and practice is not delineated. Similarly, educators are provided with little guidelines in analyzing why children do not grasp the number facts or how to account for and analyze errors.

Few, if any, studies focus on the developmental readiness of children to learn multiplication number facts. Theoretically, some third grade children are capable of conceptual understanding while other children may not be capable of benefitting from a conceptual understanding instructional approach -- at least initially. The results of the present study, however, do not suggest instructional delay in multiplication number facts.

Children were able to gain accuracy in and acquire their multiplication number facts and to sustain these gains over time. What accounted for this unusually high accuracy needs to be subjected to closer scrutiny. Certainly, the user friendly characteristic of the microcomputer program, with its private, non-judgmental feedback, are critical dimensions for further study.

Individualized pacing and error elimination seem to make the microcomputer aided instruction interesting and self-motivating for the children. The development of automaticity in multiplication number fact recall can be seen as akin to skill acquisition. Like any skill, the components of multiplication (i.e., multiplying) must be practiced until they are automatic. This automaticity ensures that the skill is accessible and reliable, and once the child can depend upon his ability to recall multiplication number facts accurately, it is theorized he should be able to focus more attention on higher order mathematical manipulation. Lack of automaticity means attention must be continuously diverted to lower order skills which can confuse, confound, and discourage higher order achievement. In this sense, automaticity seems a necessary component of mathematical competence.

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Table 1

Mean Age and SRA Scores of Treatment and Non-treatment Groups

	overall	Treatment mean (30)	Non-treatment mean (24)
Age	8.5	8.5	8.6
SRA Scores			
Ability Quotient	106.7	107.5	105.8
Mathematics	54.0	52.6	55.8
Reading	50.3	53.6	46.2

Table 2

Means and Standard Deviations of Subjects' Training Data from the Instructional Program[1]

	mean	standard deviation
Trials	24.8	7.1
Responses	2825.7	918.7
Errors	65.8	35.8
Errors per response	0.023	0.011

1 N = 30

Table 3

Means and Standard Deviations of Subjects' Scores on Assessments

	Treatment (30)		Non-Treatment (24)			
	mean	s.d.	mean	s.d.	T Value	Sig of T
Assessment 1	17.2	16.9	21.2	15.1	0.917	$p > .05$
Assessment 2	93.7	5.7	18.8	19.2	18.5	$p < .05$
Assessment 3	95.5	4.1	81.8	12.7	5.077	$p < .05$

Table 4

Number and Percentage of Incorrect Responses on Assessments 2 and 3 (Exit and Follow-up) by Number Fact Table

Table	Exit Assessment		Follow-up Assessment	
	number	percent	number	percent
0's	6	3.2	4	3.0
1's	9	4.8	10	7.4
2's	8	4.2	6	4.4
3's	7	3.7	5	3.8
4's	20	10.6	13	9.6
5's	4	2.1	3	2.2
6's	32	16.9	20	14.8
7's	34	18.0	26	19.3
8's	52	27.5	37	27.4
9's	17	9.0	11	8.1
total	189	100.0	135	100.0

Figure 1. Incorrect Responses by Number Fact Table for Exit and Follow-up Assesment Tests

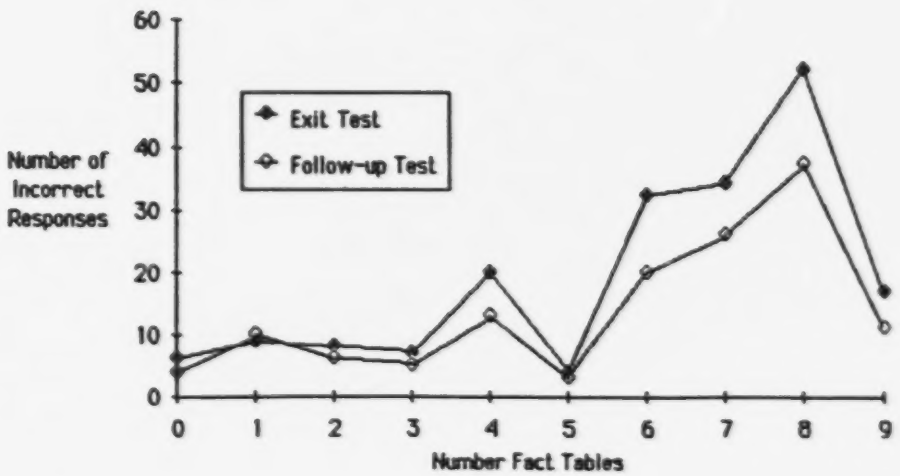

Table 5

Frequency of Assessment 2 (Exit) Incorrect Responses by Item

		number fact tables										
	X	0	1	2	3	4	5	6	7	8	9	
f	0	-	2	-	-	-	3	-	-	1	1	7
	1	-	6	-	-	-	1	-	2	1	1	11
	2	-	-	-	-	-	-	-	1	1	-	2
a	3	-	-	2	-	-	-	-	-	4	1	7
c	4	2	-	-	3	2	-	6	6	8	3	30
t	5	-	-	-	-	-	-	-	-	1	-	1
o	6	1	1	3	-	2	-	6	8	8	2	31
r	7	1	-	1	2	6	-	8	8	10	3	39
s	8	1	-	-	2	8	-	7	5	11	4	38
	9	1	-	2	-	2	-	5	4	7	2	23
totals		6	9	8	7	20	4	32	34	52	17	189

Table 6

Frequency of Assessment 3 (Follow-up) Incorrect Responses by Item

		number fact tables										
	X	0	1	2	3	4	5	6	7	8	9	
factors	0	-	3	-	-	-	2	1	1	2	-	9
	1	-	4	-	-	-	-	-	-	-	-	4
	2	-	2	3	-	-	-	-	-	2	-	7
	3	-	-	-	-	-	-	-	-	3	1	4
	4	1	-	-	-	1	-	1	4	6	2	15
	5	-	-	-	-	-	1	-	-	-	-	1
	6	1	1	-	-	1	-	2	5	6	1	17
	7	1	-	1	2	6	-	7	7	6	4	34
	8	1	-	2	3	3	-	6	6	7	3	31
	9	-	-	-	-	2	-	3	3	5	-	13
totals		4	10	6	5	13	3	20	26	37	11	135

Table 7

Frequency of "Difficult" Number Facts Identified on Assessments 2 and 3 (Exit and Follow-up)

number fact	frequency of incorrect response	number fact	frequency of incorrect response
8 x 8	18	0 x 1	5
7 x 8	16	4 x 3	5
7 x 6	15	7 x 3	5
7 x 7	15	8 x 3	5
6 x 8	14	0 x 5	5
4 x 8	14	4 x 6	5
8 x 6	13	4 x 9	5
6 x 7	13	9 x 4	4
7 x 4	12	4 x 0	3
9 x 8	12	2 x 2	3
8 x 4	11	6 x 2	3
8 x 7	11	4 x 4	3
1 x 1	10	6 x 4	3
4 x 7	10	1 x 7	3
6 x 6	8	0 x 8	3
9 x 6	8	2 x 8	3
9 x 7	7	6 x 9	3
3 x 8	7	2 x 1	2
7 x 9	7	3 x 2	2
8 x 9	7	8 x 2	2
		9 x 2	2

Table 8

Mean, Standard Deviation, and Range of Drill and Practice Trials by Table

table	mean	s.d.	range	95% Confidence Interval	
				lower bound	upper bound
2's	1.4	0.568	1 - 3	1.2	1.6
3's	3.6	2.012	1 - 8	2.9	4.3
4's	3.8	2.107	0 - 10	3.0	4.6
5's	0.9	1.373	0 - 7	0.4	1.4
6's	4.2	2.1	0 - 8	3.4	5.0
7's	2.9	1.592	0 - 7	2.3	3.5
8's	2.1	1.332	0 - 6	1.6	2.6
9's	0.6	0.621	0 - 2	0.4	0.8

Figure 2. Mean Number of Drill and Practice Trials by Number Fact Table with 95% Confidence Intervals